Ecological notes on the East Gippsland Burrowing Crayfish *Engaeus orientalis*, including burrow structure and associated fauna

James A. Fitzsimons[1,2] & Mark J. Antos[3]

[1]School of Life and Environmental Sciences, Deakin University, 221 Burwood Highway, Burwood VIC 3125, Australia. Email: james.fitzsimons@deakin.edu.au

[2]The Nature Conservancy, Suite 3-04, 60 Leicester Street, Carlton VIC 3053, Australia.

[3]Research Branch, Parks Victoria, Level 10, 535 Bourke Street, Melbourne VIC 3000, Australia.
Email: mantos@parks.vic.gov.au

ABSTRACT

Despite Australia having a high diversity of freshwater crayfish species, the ecology of many of these species remains poorly known, particularly burrowing crayfish of the genus *Engaeus*. Biological information on colour, behaviour, burrow structure, associated burrow fauna and habitat of the East Gippsland Burrowing Crayfish *Engaeus orientalis* obtained during incidental observations in 2007 and 2008 is provided. The burrow structure took the form of radiating runways under a rock slab, while the burrow location was in a semi-disturbed site away from water. Both are atypical for this species.

Key words: East Gippsland Burrowing Crayfish, *Engaeus orientalis,* pholeteros, crayfish burrows

Introduction

One of the most diverse Australian freshwater crayfish genera is *Engaeus*, which contains approximately 34 species, all found in southeastern Australia (Horwitz 1990). This level of diversity in a relatively small geographical area is considered to be noteworthy (Horwitz 1990). However, the ecology of these Australian burrowing crayfish remains poorly known (Horwitz 1995a). This is due to a combination of factors including a lack of commercial or recreational significance of individual species, cryptic behaviour, the difficulty of obtaining specimens (because of their burrowing nature), uncertain taxonomy and a lack of experts capable of locating and identifying species (Horwitz 1990; Hansen and Richardson 1999; O'Brien 2007). Few studies have described aspects of burrowing crayfish ecology from field surveys and observations (e.g. Suter and Richardson 1977; Richardson and Swain 1980; Horwitz *et al.* 1985a,b; Horwitz 1990; Richards 1998; March and Robson 2006; Wapstra *et al.* 2006).

Members of the *Engaeus* genus display a high level of species diversity but have restricted distributions (e.g. Morey and Hollis 1997; van Praagh and Hinkley 1999; Richardson *et al.* 2006). As a consequence, many species are regarded as being of conservation concern. For instance, 10 of the 22 species found in Victoria, are considered to be threatened (O'Brien 2007). Documenting ecological information on crayfish species improves assessments of distribution, conservation status and management prescriptions.

This note provides ecological information on the East Gippsland Burrowing Crayfish *Engaeus orientalis* obtained during incidental observations in 2007 and 2008. The unusual nature of the burrow allowed repeat observations as it could be observed without the need for extraction and destruction of the burrow. Although not currently considered threatened (O'Brien 2007), the East Gippsland Burrowing Crayfish is a poorly-known species endemic to East Gippsland and far south eastern New South Wales. Most records of this species are from the banks of creeks and rivers from lowland areas (Clark 1936; Horwitz 1990; O'Brien 2007; McCormack 2008; Fig. 1). There are no detailed observations published on the ecology of this species.

Observations

Burrow location

The burrow of an East Gippsland Burrowing Crayfish was discovered opportunistically after lifting a relatively flat granite boulder (approximately 40 cm wide) on 7 April 2007 (Fig. 2). The burrow was inspected again on 20 March 2008. The boulder was located off Goolengook Road, which is a rough earthen track, in the Goolengook Forest Block, East Gippsland, Victoria (Zone 55, 0661780, 5853630; Elevation 351 m asl) (Fig. 1). Here the road contours along a steep slope before dropping down into a gully containing a tributary of the Goolengook River. There was a very shallow depression where the road met an

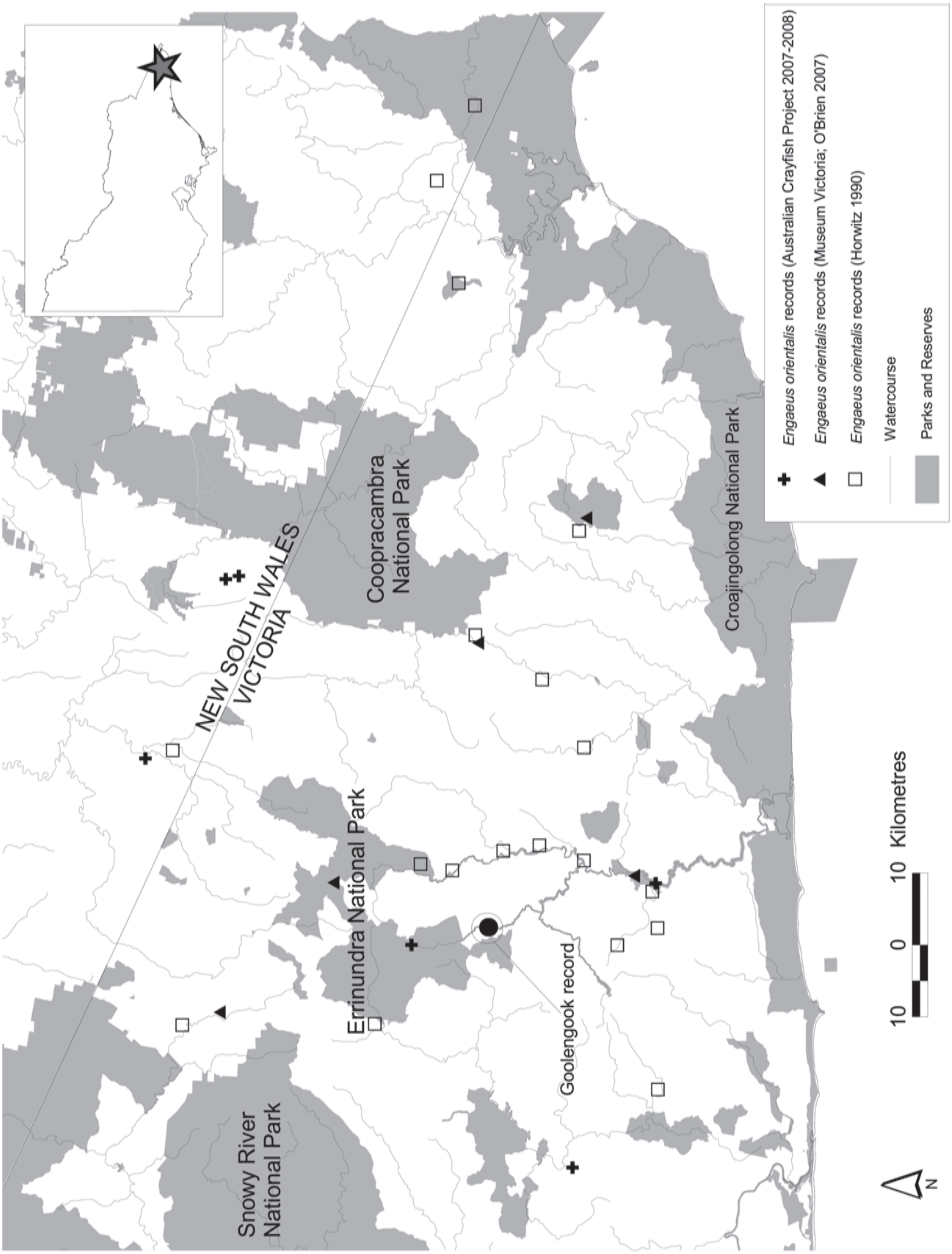
Engaeus orientalis records (Australian Crayfish Project 2007-2008)
Engaeus orientalis records (Museum Victoria; O'Brien 2007)
Engaeus orientalis records (Horwitz 1990)
Watercourse
Parks and Reserves
NEW SOUTH WALES
VICTORIA
Coopracambra National Park
Croajingolong National Park
Errinundra National Park
Snowy River National Park
Goolengook record
10
0
10
Kilometres
N

Figure 1. Distribution of past records for the East Gippsland Burrowing Crayfish and the location of the Goolengook record reported on in this study.

embankment on the uphill side of the track but there was no standing water or obvious muddy areas present (Fig. 2). The nearest flowing stream to the site was approximately 500 metres away and at an elevation approximately 70 metres below that of the track. The angular, unweathered surface of the granite boulder under which the burrow was located suggested that it was likely to have been created as a result of the blasting of larger granite slabs during the construction of the track.

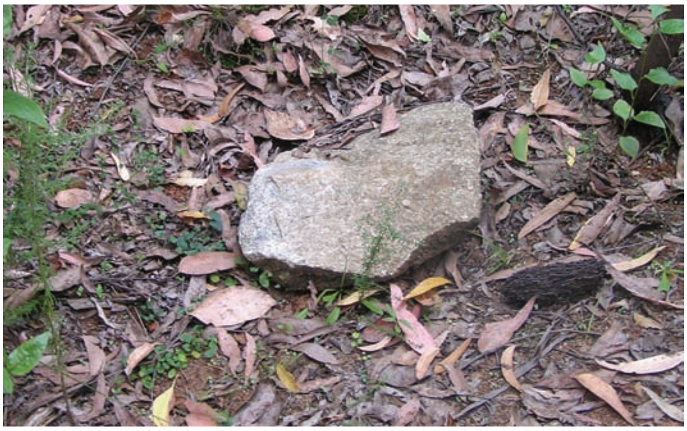

Figure 2. Granite slab covering burrow and chamber. Photo: James Fitzsimons

The vegetation surrounding the burrow is classified as Damp Forest according to White *et al.* (2006) and was dominated by Mountain Grey Gum *Eucalyptus cypellocarpa.* Plants located in the immediate vicinity of the burrow included *Cassinia aculeata, Goodenia ovata, Goodia lotifolia, Olearia argophylla, Telopea oreades* and *Viola hederacea*. The ground layer contained a very shallow litter layer and sparse mosses (Fig. 2). Parts of the area surrounding the site had been previously disturbed by logging, with the most recent activity occurring between the late 1990s and early 2000s (VEAC 2006). These logged areas consisted of regrowth vegetation.

Burrow characteristics

The burrow consisted of a network of approximately ten individual 'runways' located underneath the boulder leading to a central chamber. The runways extended to the surface around the edges of the covering boulder (Fig. 3). The central chamber was approximately 10 cm deep and 5 cm wide with no connecting tunnels (Fig. 3). The bottom of the chamber was rounded and consisted of wet clay but there was no standing water present in either year. No earth chimneys were present at the entrances to the burrow.

Between the 2007 and 2008 observations of the burrow, there appeared to be some slight changes to the runway paths, and the runways were less defined resulting from what appeared to be an increase in the amount of soil excavated beneath the boulder.

Species identification

Photographs of the crayfish taken in 2008 allowed experts to identify the species as the East Gippsland Burrowing Crayfish *Engaeus orientalis* (T. Raadik pers. comm. 2008 from Horwitz 1990, 1995b). This identification was based on the following characteristics:

- A small exopodite of the third maxilliped which is shorter than the ischium;
- The 'hairiness' of the chelae which resembles a female *E. orientalis*; and
- Collection location which is in the middle of the known range of *E. orientalis*, and east of the known range of the North East Burrowing Crayfish *E. cymus* which can be similar in appearance.

Various points regarding the uropods and the sternal pore presence/absence and arrangement were not able to be determined from the photographs.

The upper surfaces of the animals were generally dull burgundy (with minor areas of dark orange including the lateral cephalic and the cervical groove at the apex) while the inner legs, lower merus, and tips of claws (dactyl and propodus) were lighter orange (Figs. 4 and 5).

Burrow occupancy

During the 2007 visit, two East Gippsland Burrowing Crayfish were found in the burrow. One individual was slightly larger than the other. During the 2008 visit, only one animal was present in the burrow.

A number of other invertebrates were observed co-habiting the crayfish burrow. During 2007, a spider (possibly a wolf spider) was found in the burrow and a small (<5mm) cicada (Cicadidae) nymph (K. Walker pers. comm. 2007) was attached to the carapace of one of the crayfish (Fig. 6). During the 2008 visit, a wolf spider (Lycosidae) was located in one of the runways, and an amphipod and a

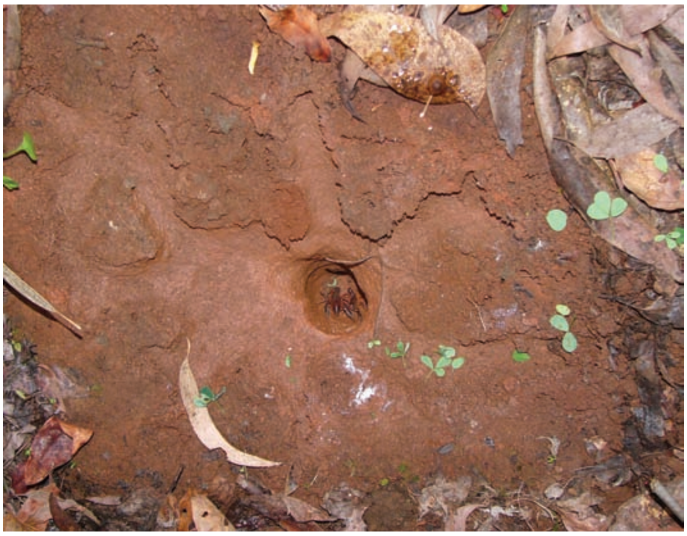

Figure 3. Runways and chamber under granite slab from 2007. Photo: Guy Dutson

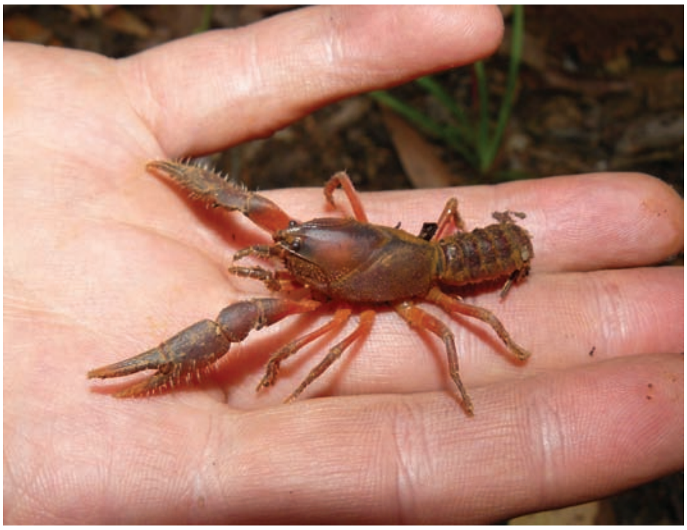

Figure 4. Profile of the East Gippsland Burrowing Crayfish in 2008. Photo: Mark Antos

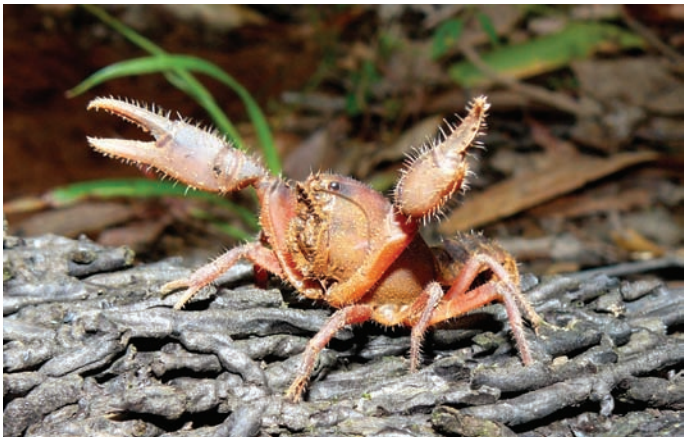

Figure 5. Defensive pose of the East Gippsland Burrowing Crayfish in 2008. Photo: Mark Antos

medium-sized dead meat ant (Formicidae) were located in the chamber of the burrow. Small ants were found to have created a nest along one of the runways.

At the conclusion of observations on each occasion all animals were returned to the burrow and the granite boulder was carefully replaced.

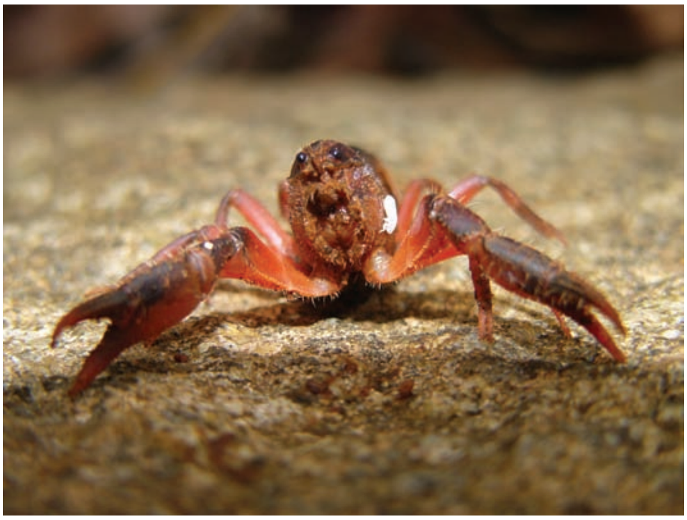

Figure 6. Cicada nymph on carapace of crayfish in 2007. Photo: Guy Dutson

Discussion

These observations provide information on the habitat and burrow structure of a poorly known species. Horwitz (1990) suggests that *Engaeus orientalis* is widely distributed in East Gippsland, especially east of the Snowy River and that this species has also been found in New South Wales at Craigie and Timbillica. Our observation at Goolengook lie within this previously described distribution of this species (Clark 1936; Horwitz 1990; O'Brien 2007).

The East Gippsland Burrowing Crayfish has been described to be frequently found in creeks in wet sclerophyll forest or warm temperate rainforest and has also been found in creeks in dry sclerophyll forest and in a tea-tree swamp (Horwitz 1990). The location of the burrow at Goolengook was unusual in that it did not occur in close proximity to a watercourse or drainage line, suggesting that the East Gippsland Burrowing Crayfish might be more versatile in its burrow construction and distributed across a wider range of habitat types than previously recorded. These observations have demonstrated that this species is capable of inhabiting partially disturbed sites. Similarly, other species of burrowing crayfish have also been reported to inhabit disturbed sites such as roadside gravel and beneath cording on walking tracks (Hansen and Richardson 1999).

The structure and location of the burrow observed in this study appears to be atypical for those previously recorded for this species. Horwitz (1990) describes this species as occupying 'Type 2' burrows (i.e. those connected to the water table) or 'Type 3' burrows (i.e. those independent of the water table) but usually the former (burrow classification sensu Horwitz and Richardson 1986). Few further details on burrow structure are provided by Horwitz (1990).

Individuals of the East Gippsland Burrowing Crayfish have been previously reported to share burrow chambers. Adult males and females have been found in the same burrow, as have family groups consisting of a pair of adults and a number of juveniles (Horwitz 1990). It is believed that mating and egg production occurs in late spring or early summer, with juveniles released in early autumn and sometimes retained in burrows until the next spring (Horwitz 1990). Our initial observations in 2007 were not detailed enough to reveal whether the two individuals sharing the burrow were male and female or adult and juvenile.

Our observations revealed that the crayfish burrow provided microhabitats for several other invertebrate species. The use of crayfish burrows by other organisms ('pholeteros') has been documented for other *Engaeus* species with groups such as spiders, amphipods and crustaceans recorded in both occupied and unoccupied burrows (Suter and Richardson 1977; Horwitz *et al.* 1985a; Horwitz pers. comm. 2007). However, neither ants nor cicadas have been previously recorded in crayfish burrows and it is probable that these areas offer shelter and a moist environment for other invertebrate species and may act as refuges from hot and dry environmental conditions.

The fact that crayfish were located within the same burrow nearly a year apart provides some measure of how long an individual burrow may remain active. The changes detected in the pattern of runways between 2007 and 2008 indicate that these burrows are subject to regular maintenance. There is currently very little information available on how long individual burrows are used by crayfish and the unique characteristics of this burrow allow for new insights into occupancy and burrow morphology.

This note provides further information on burrow structure and habitat types of the poorly-known East Gippsland Burrowing Crayfish. This particular burrow was different from most other burrows used by this species. It may be that this species is more adaptable than previously thought given that the burrow was located away from a watercourse, was of a different burrow type and at a previously disturbed site.

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